

THE RECLAMATION POTENTIAL OF A SAND AND GRAVEL SITE  
IN LINN COUNTY, OREGON: LOWER KIGER ISLAND

by

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## THE RECLAMATION POTENTIAL OF A SAND AND GRAVEL SITE IN LINN COUNTY, OREGON: LOWER KIGER ISLAND

ABSTRACT: The objective of this paper is to conduct a geographical inventory of a sand and gravel site, Lower Kiger Island, so as to identify and evaluate other potential land uses subsequent to the extraction of its aggregate resources. This information is intended to aid citizens, land use planners, and sand and gravel operators to better evaluate the potential uses of the mined-out site.

Lower Kiger Island was chosen for study because the aggregate extraction upon it serves as an example of a transitional land use located between two growing urban centers, Corvallis and Albany. The locational situation may act to increase pressures to convert the site to a number of other land uses. A site and land use analysis was conducted in order to analyze land use alternatives for Lower Kiger Island and also to identify existing or potential conflicting land use demands for this aggregate resource site. The opportunities and constraints of each land use having reclamation potential were evaluated in terms of the site's physical characteristics, economic considerations and the existing land use planning framework.

Sand and gravel extraction is the existing land use on Lower Kiger Island; however, following the extraction of aggregates from the site, a number of mutually compatible land uses can be incorporated into a reclamation plan. This study indicates that in order to develop this multiple use potential, an organized and coordinated planning program must be established.

### INTRODUCTION

An introduction to the nature of sand and gravel deposits in Oregon is

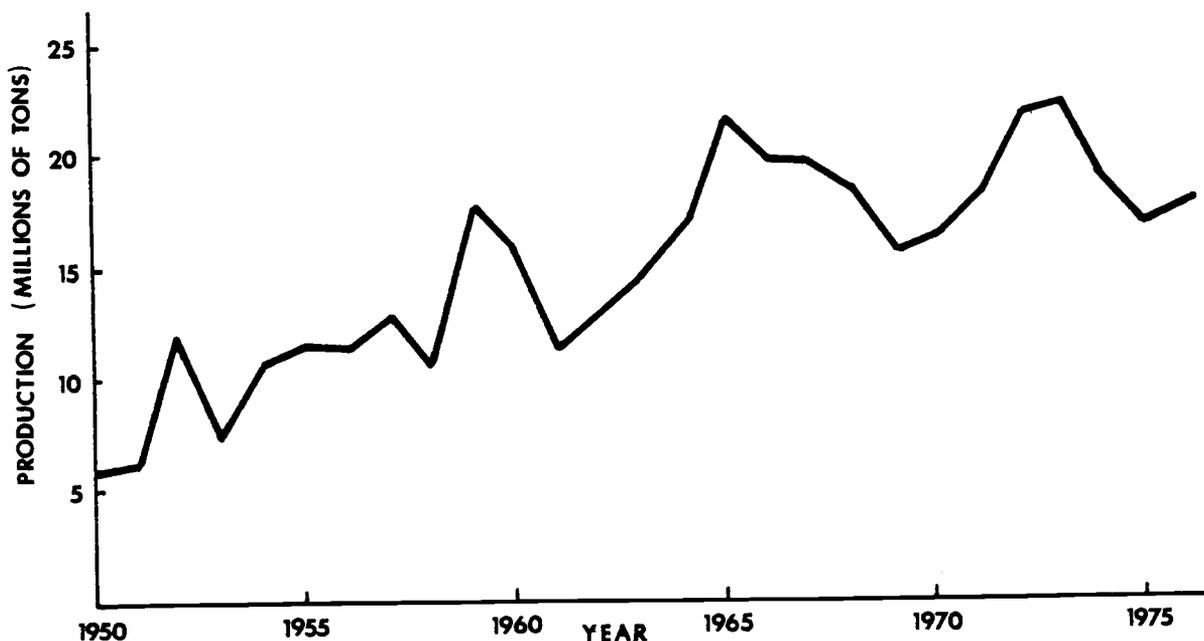
requisite to an understanding of the need to provide for present and future aggregate needs as well as to demonstrate the reclamation potentials of mined-out sites.

The term aggregate refers to sand, gravel, and crushed or broken rock found as mineral deposits. The term sand and gravel refers to the size of the aggregate material and not to the mineral content or rock type. The sand and gravel deposits in the Willamette Valley are alluvial, having been deposited by streams and rivers as a result of bed load transport of materials. The sand and gravel industry is necessarily restricted to those locations where nature has deposited its raw materials. "Present-day deposits occur in the form of bars within stream channels and as point bars along the inside banks of meanders. Previously deposited point bars occur in the Willamette River floodplain in old meander channels and beneath the floodplain..."<sup>1</sup> Also, the sand and gravel industry is self-consuming, which is to say that the longer it operates at any one location, the shorter its remaining life span. The reason for this is that these resources are essentially non-renewable, having been created in the past and not renewed within the human time frame. An undetermined amount of river-borne aggregate that normally migrates downstream has been blocked by dams along the tributaries of the Willamette River.<sup>2</sup> The result is that aggregate in the river is not recharging at a rate equal to or greater than its harvest rate. Another important consideration having a significant effect upon the sand and gravel industry is that the value-to-weight ratio is quite low for its products, so transportation distance becomes particularly important. "To be economic both in a monetary and energy savings sense, aggregate resources need to be large, good quality, and within a short haul distance from place of use."<sup>3</sup> Hauling costs, which constitute typically about 35-50 percent of their total costs, are said to be uneconomic for distances

greater than twenty miles.<sup>4</sup>

Sand and gravel production is the leading mineral industry in the Willamette River basin, both in terms of quantity and value. Although the data shown in Figure 1 indicate considerable fluctuation in the production of aggregate materials over the period 1940-1976, a long-term trend of rising production for the State of Oregon is apparent. This trend stems directly from the state's general economic and population growth.<sup>5</sup> The

**FIG. 1 ADJUSTED STATEWIDE PRODUCTION OF SAND & GRAVEL**



SOURCE: Analysis and Forecasts of the Demand for Rock Materials in Oregon (1979).

Willamette Valley, with most of Oregon's population and economic activity, produces about 71 percent of the state's sand and gravel resources.<sup>6</sup> As the population of the Willamette Valley is expected to continue to increase in the future, an increase in per capita consumption of aggregate products will result, due mainly to a proliferation of urban services. The 1976 per capita consumption of aggregate material in the Valley was 12 tons per capita; per capita consumption in the year 2000 is estimated at 22 tons per capita.<sup>7</sup> Unfortunately, community growth can "simultaneously restrict the use of existing sources of aggregate by zoning, encroachment of incompatible development, and loss of rock material deposits when

structures are built over them."<sup>8</sup> Thus, it is important to identify and reserve sand and gravel deposits best situated to meet aggregate demands prior to their preemption by cultural land uses. However, this effort must be guided by sound land use planning policies assuring that aggregate extraction is compatible with adjacent land uses and that appropriate reclamation plans are made.

As pressures increase upon a limited supply of land, it becomes increasingly important to identify and evaluate the social, economic and environmental effects associated with specific land uses. The State of Oregon has recognized the need for both extraction and reclamation of aggregate resource areas. Statewide Land Use Planning Goal #5 directs local governing bodies to take the provision of aggregates into consideration within comprehensive plans, and the Mined Lands Reclamation Law of 1972 directs the State Department of Geology and Mineral Industries (DOGAMI) to administer all mining activity within the state and to provide for cooperation between private and governmental bodies in carrying out the intent of the Law. The Legislative Assembly found that "proper reclamation of surface-mined lands is necessary to prevent undesirable land and water conditions that would be detrimental to the general welfare, health, safety and property rights of the citizens of this state."<sup>9</sup>

The sand and gravel industry has a significant impact upon the environment as well as upon economic stability and growth. A reliable data base of all aggregate resources within the county is needed by citizens, planners, and sand and gravel operators so that a balance can be made between the need to develop this resource and the need to protect the environment. Truly comprehensive land use planning policies can be effective, positive management tools to assure the conservation of aggregate resources.

## OBJECTIVES

The primary objective of this paper is to conduct a geographical inventory of Lower Kiger Island that will be of practical value to those interested in the assessment of the reclamation potentials of this aggregate site. To that end, a site and land use analysis has been conducted. A description of the planning framework, within which the sand and gravel industry must operate and reclaim its aggregate sites, will be followed by an evaluation of the opportunities and constraints of each potential reclamation land use. Finally, a number of recommendations will be made that can serve to ensure the development of a coordinated and comprehensive reclamation program for Lower Kiger Island.

## RESEARCH METHODOLOGY

The selection of a suitable sand and gravel site was the first task presented in this research project. As most sand and gravel deposits are found along streams and rivers, and are close to urban centers, a survey of the Willamette River in the vicinity of Corvallis was conducted to determine if any active aggregate sites exist that might potentially serve a number of different land uses. Lower Kiger Island was selected because it was found to be one of Linn County's most productive and active aggregate resource sites, and because it is located mid-way between the two growing urban centers, Corvallis and Albany. Additionally, the site contains productive agricultural soils, and its riverine location presents a water-related recreation potentials.

A combination of sources and research techniques were used to conduct a site and land use analysis of Lower Kiger Island. These sources and techniques include:

- 1) A review of locational information from topographic quadrangles, assessors' maps, zoning maps, and on-site surveys;
- 2) An analysis of geology, soils, vegetation, hydrology and wildlife using the Rock Materials Resources of Benton County, Oregon, Linn County soils survey information, aerial photography, site surveys, and selected reports and interviews;
- 3) An investigation of land use relationships by air photo analysis of past and present land use patterns and changes on Lower Kiger Island, reference to established reclamation plans for the site, and interviews with persons familiar with the site and operation.

A review and analysis of the planning framework within which the aggregate industry must operate was undertaken in order to assess the roles and responsibilities of the applicable state and federal agencies, the County planning department and the operator of the site. The Statewide Land Use Planning Goals and Guidelines, the Mined Land Reclamation Law, and Linn County planning policies were the principal sources for this section of the paper.

The site and land use information was used to identify a number of potential reclamation land uses for Lower Kiger Island. The opportunities and constraints of each were evaluated in terms of the site's physical characteristics, economic considerations, and the existing land use planning framework. The National Sand and Gravel Association has published a series of reports on all phases of reclaiming sand and gravel sites; these, as well as the Fischer Island Reclamation Plan were invaluable resources for writing this paper.

## SITE AND LAND USE ANALYSIS

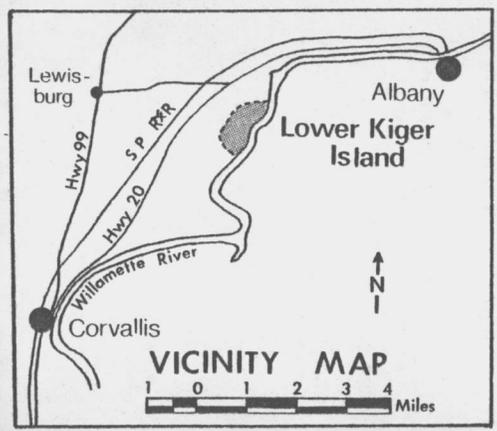
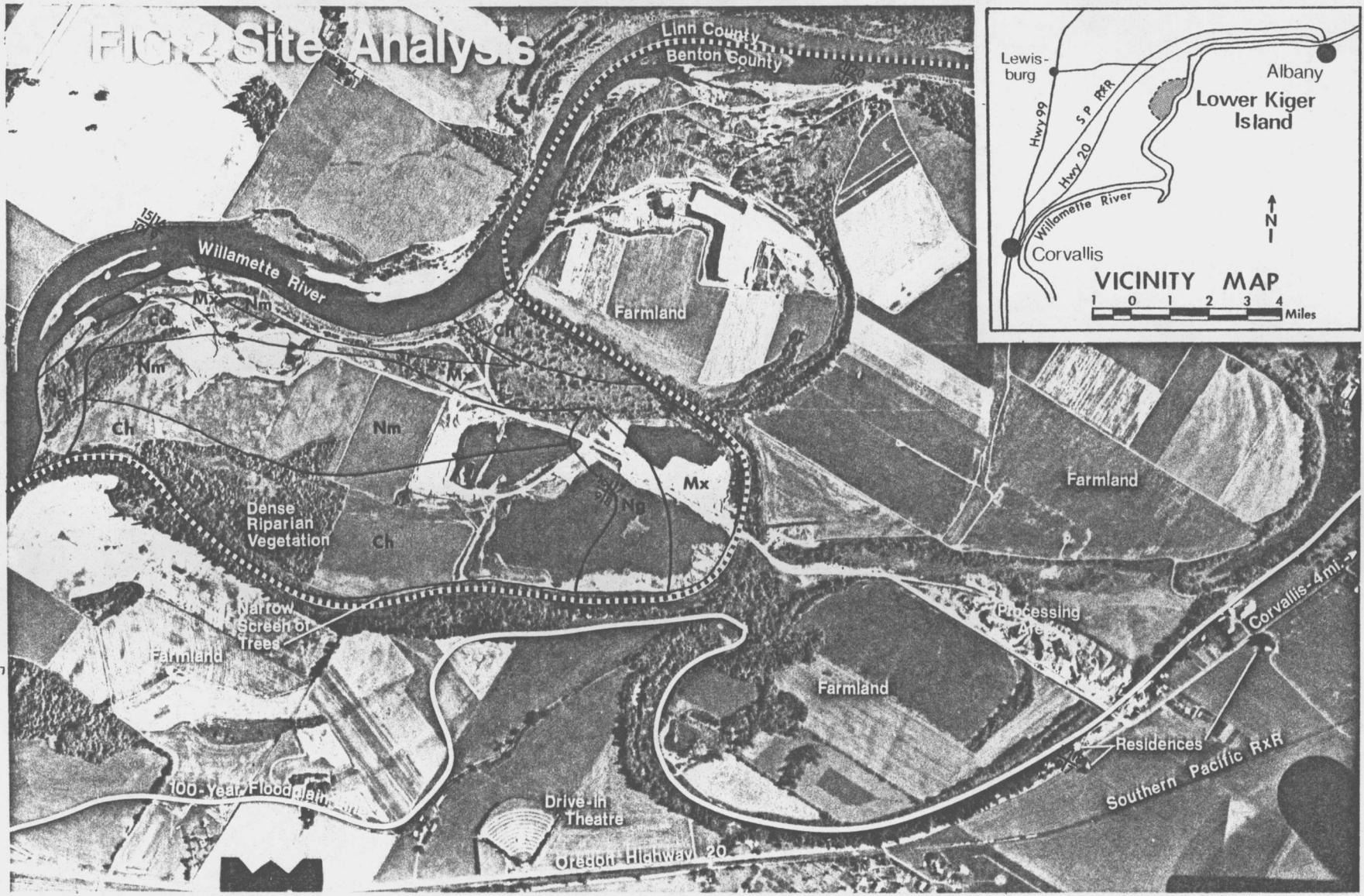
Locational Data

Lower Kiger Island is located along the Willamette River between the cities of Corvallis and Albany with populations of 38,538 and 27,030, respectively.<sup>10</sup> It falls within portions of Sections 8, 9, 16, and 17 of T.11S., R.4W. on the Albany quadrangle (Fig. 2). The island's long axis is generally from north to south, and it is approximately 1½ miles long and half-mile wide. This 345-acre site was "created" when the 1852 Willamette River channel, now considered by Linn and Benton counties to be the official county line, shifted to the east, effectively isolating the site. As a result, Lower Kiger Island is actually located within Linn County, even though it is situated westward of the present-day river channel. Lower Kiger Island is privately owned by the Wildish Sand and Gravel Company. Access to the site is along a haul road from Oregon Highway 20, past the main office, the processing plant and the stockpile area. Adjacent to the highway runs a Southern Pacific railroad line which could serve as a potential aggregate transport option as the energy costs for truck hauling continue to rise (Fig. 2).

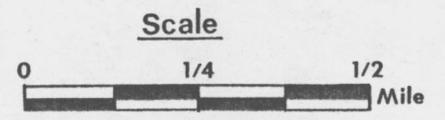
Geology

Inundation and sedimentation during Quaternary geologic time have resulted in numerous alluvial geologic units consisting of unconsolidated and semi-consolidated deposits of sand, gravel, silt and clay of varying extent and thickness along the Willamette River. The Lower Kiger Island area is described as a Quaternary lower terrace unit, found just above Recent river alluvium, which is a geologic unit characterized by point bar development. This lower terrace varies anywhere from a few feet to eight feet or more above river level and features a low, undulating, fluvial surface resulting

# FIG 2 Site Analysis



# LOWER KIGER ISLAND



from overbank flooding and flood deposits. Deposits on these terraces can be up to 35 feet deep; however, they are complex in composition, being imperfectly stratified and poorly sorted. A sandy loam overburden has buried the sand and gravel deposits, in some areas up to 10 feet or more.

It is estimated in the Rock Material Resources of Benton County, Oregon that 58 acres on Lower Kiger Island have thus far been excavated, representing a little over one-fifth its total estimated extractive potential of 19,200,000 tons--the largest in the Benton County area.<sup>11</sup>

### Soils

Lower Kiger's soil series data can be used not only to describe their relative suitability for a variety of land uses, but also as a guide to determine probable sources of sand and gravel. Because the Willamette River is a mature river, the alluvial soils have had a long period of sedimentary soil building. The productivity of these alluvial soils is demonstrated by the fact that a majority of the land along the river has been put to agricultural use. The soil series on the island include Chehalis silty clay loam (Ch), Newberg fine sandy loam and Newberg loam (Ng and Nm, respectively), Camas gravelly sandy loam (Ca), and Mixed alluvium (Mx). Note their areal distribution and suitability characteristics (Fig. 2 and Table 1). Much of the aggregate extraction has been or is now being conducted upon the sand- and gravel-rich Chehalis, Camas and Mixed alluvium soils. The central portion of the site is being farmed upon the productive Newberg and Chehalis soils. Both the Chehalis and Newberg soils are found within Soils Conservation Service capability class II, indicating moderate limitations to the cultivation of field crops. The Mixed alluvium soils are in soil capability class VII, indicating that these areas have severe limitations to crop cultivation. These soils are well-drained to excessively well-

TABLE 1. SOILS SERIES AND SUITABILITY

SOIL SERIES \ SUITABILITY FOR...	Topsoil	Sand and Gravel	Embankments - Dikes	Irrigation	Clay Fill	Recreation	Wildlife Habitat	Structural
Chehalis		x						
Newberg		x						
Camas								
Mixed Alluvium								
x Thick Overburden		Good Suitability		Fair Suitability		Unsuitable		

SOURCE: Adapted from The Fischer Island Reclamation Plan and the Benton County Soils Survey

drained, and subject to frequent flooding. It must be stressed, however, that as sand and gravel extraction is the established and primary land use, the areas now being farmed, a total of 59 acres, or 17% of the site, will be the next to be mined. Typical crops are carrots and corn. In order to expose the aggregate materials below, the soils, which are collectively termed overburden, must first be removed. Overburden is used to construct earth fill dike roadways, to topdress where vegetation is to be established, and also sold as commercial material. All soils on Lower Kiger Island are subject to flooding, and therefore impose severe limitations to residential or commercial development.

### Vegetation

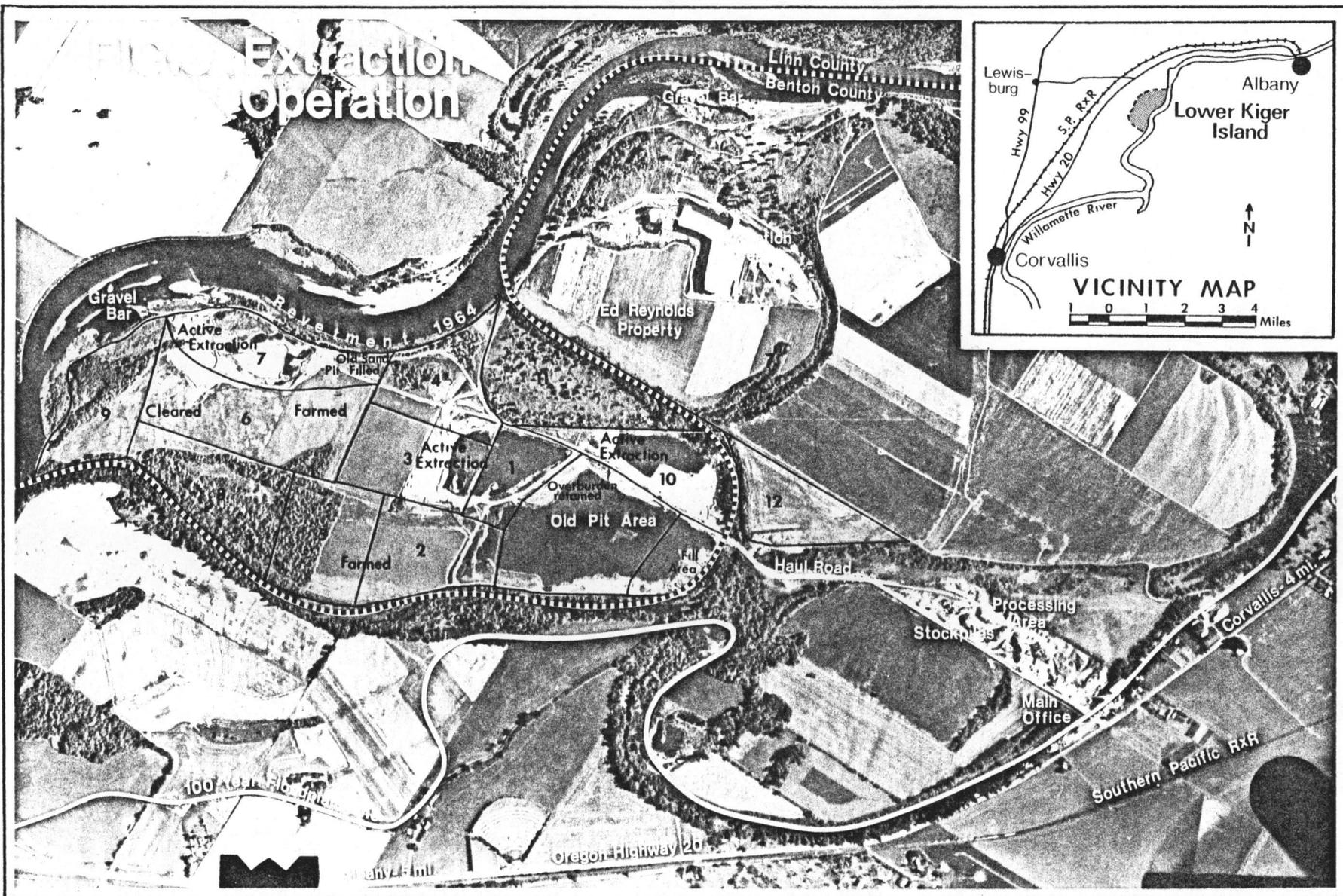
Prior to the conversion of Lower Kiger Island to agricultural and industrial uses, riparian vegetation including stands of black cottonwood and a dense shrubby understory, dominated large areas of the site. Tree and shrub clearing, however, is now the first step to converting the land to agriculture prior to its scheduled aggregate removal. Approximately 210 acres, or 61% of the site, has been cleared for this reason, and it can be

assumed that much of the remaining vegetation will be removed in the future as deposit or market conditions dictate. Dense stands of riparian vegetation are found within Sections 5, 8 and 9; Section 11 is sparsely covered with trees and brush (Fig. 3). A screen of vegetation existing along the periphery of Lower Kiger Island will remain untouched, as required by the County and DOGAMI. It can provide a habitat for wildlife, food and shade for fish populations, anchor riverbank soils and protect agricultural lands from seasonal flooding, control trespass, and preserve scenic qualities and views.

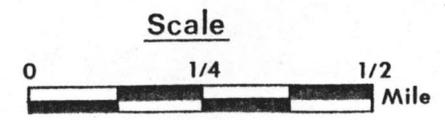
### Hydrology

Lower Kiger Island is located entirely within the 100-year floodplain of the Willamette River, as shown on Figure 2, and portions of the site are subject to inundation by flood waters during the main flood season, from October to April for the region. The average annual rainfall for the area is 40 inches. Most of the larger floods occur during the months of December and January as a result of heavy rains, augmented by snow melt at a time when the soil is near saturation from prior rains. The duration of floods on the Willamette River ranges up to eight to nine days with peak flow periods occurring over a period of three to four days. River velocity varies from 2.9 ft/sec in August to 4.4 ft/sec in February; velocities greater than 3 ft/sec, combined with depths of three feet or more are considered hazardous for recreation.<sup>12</sup>

The northeastern end of the island is located at an inside bend of the main river channel, favoring the development of a sand and gravel bar there. The eastern side of the island is located at an outside bend, or cut-bank side of the main river channel. In 1964 revetment was placed along the entire length of this cut-bank in order to retard erosion of aggregate



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materials and soils (Fig. 3). The existence of a high water table is demonstrated by shallow ponding and permanent water impoundments within extraction pits. There are four extraction ponds at this time; the largest is the 36-acre pit at the southwestern end of the island. Under two approved DEQ solid waste disposal permits, construction debris, wood waste material, and operations screenings are being backfilled into this pit into clay-lined cells that isolate them from the groundwater (Fig. 3).<sup>13</sup> The muddled appearance of the easternmost pond is evidence of recent extraction (Fig. 3).

As mentioned previously, the island's floodplain location places strict limitations upon the number and intensity of land uses upon the site. Potential loss of life and property dictates that structural development be restricted here. At the same time, however, this floodplain location protects and conserves those natural resource activities important to the river environment.

### Fish and Wildlife

The meandering course of the Willamette River through the valley has created an excellent wildlife habitat. Gravel bars, backwaters, islands, riparian vegetation, and sloughs are essential components of this unique ecosystem. The extent to which Lower Kiger Island has been cleared of its natural vegetation has clearly had a negative impact upon the suitability of the site as a wildlife habitat. Although none were noted on the island during site surveys, gophers, ground squirrels, moles, opossums and other fur-bearing animals are likely to inhabit the remaining vegetated areas. Pheasant, valley quail, morning dove, and numerous songbirds are also found in this region. The main channel of the Willamette River is a major route of the Pacific flyway. Migratory waterfowl rest and feed along the

river in large numbers. Cranes, ducks, geese and other waterfowl were noted in the area.

The Willamette River supports an abundance and variety of fish life. Angling is directed at adult salmon, steelhead, warm water game fish, and trout from spring to early fall. The sloughs and backwater areas of the river are the lifeline of the river for fishes, and it is in these areas that angling is most abundant.

The existence of extraction ponds on Lower Kiger Island offer possibilities for warm water fish management. This will be covered in the Reclamation Options section of this paper.

#### The Wildish Sand and Gravel Operation

Supply and Demand. The Wildish Sand and Gravel Company operation at Lower Kiger Island is favorably located to meet aggregate demands of the greater Albany-Corvallis area. The 1970-1976 combined average annual sand and gravel production for the Linn and Benton County area was 1,077,000 tons, Linn County contributing approximately two-thirds of this amount. Although specific information concerning the amount of aggregate material excavated yearly at Lower Kiger Island is treated confidentially, it is known that nearly half of the two-county yearly aggregate production occurs at this site.<sup>14</sup> Given the island's extensive extractive potential, it appears that this aggregate site can continue to be an important source of sand and gravel for the area.

The Production of Sand and Gravel. There is a relationship between the deposit, the type of excavation equipment used, the functional aspects of the operation and the final excavated form. All sand and gravel operations include six basic steps: (1) clearing, (2) stripping, (3) stockpiling, (4) excavation, (5) transporting, and (6) processing. The operating

plan attempts to coordinate the use of equipment in all these steps so as to direct the flow of sand and gravel from areas of excavation to the processing plant as efficiently as possible. The duration of the extraction operation is a function of pit depth, sand and gravel composition and local market conditions.

Excluding the 30-acre original old pit area which is being backfilled with solid wastes, Wildish Sand and Gravel has designated twelve mining sections, at an average of 23.5 acres each (Fig. 3). The extraction operation is concentrated in the sections closest to the processing plant until these areas are depleted. The operation then moves progressively eastward from section to section. Portions of Sections 2, 3, 4, 5, 6 and 12 have been cleared of all trees, shrubs, and other obstructions, leveled and put into agricultural use. A total of 59 acres are now farmed (Fig. 3). In Section 11 there has been some recent brush clearing and tree removal along its eastern border, but this land has yet to be developed for farming. When extraction of a section has begun, the overburden is first stripped so as to expose the sand- and gravel-bearing strata. The trashy upper layer of overburden is often used to construct earth fill dike roadways between excavation areas. Next, the good sandy loam overburden is removed and either sold as commercial material or stockpiled and used to cover filled pits during the reclamation phase. Stripping has begun within the western area of Section 6, and excavation is now underway within Sections 1, 7 and 10 (Fig. 3). Commercial dredging of gravels from river bar areas occurs at the eastern edge of the island and also adjacent to the Reynolds' property to the south under permits from the Corps of Engineers.<sup>15</sup>

A combination of dry and wet operations is employed during the excavation of aggregate material from Lower Kiger Island. Excavation begins with the use of front end loaders and scrapers down to the water table, and then

a dragline shovel removes the remaining material. All the equipment used during the extraction process possesses the capability for reclaiming mined-out areas. The peak of extraction operations occurs during the summer months, coinciding with the peak period of the construction industry.

The unrefined material is transported from the excavation area to the processing area by trucks and loaders. It is then fed by conveyors to the top of the processing equipment, screened, crushed, classified and stockpiled. Waste material such as silts, representing a significant landforming potential for reclamation purposes, is now being discharged into the old pit area (Fig. 3).

Wildish Sand and Gravel operates a ready-mix concrete and asphalt plant in the processing area. This represents a significant efficiency and energy-saving factory (Fig. 3).

Conflicts and Environmental Hazards. Conflicts between the operations upon Lower Kiger Island itself and the surrounding land uses are at a minimum due to the island character of the site, the buffering effect of the peripheral riparian vegetation, and the established Exclusive Farm Use zoning of the area. As an example, a cooperative arrangement now exists between Wildish Sand and Gravel and Ed Reynolds, owner of the property just south of the island: Wildish Sand and Gravel now extracts sand and gravel from the Reynolds property and Ed Reynolds farms cleared portions of Lower Kiger Island.<sup>16</sup> Additionally, although the processing plant and stockpile area are typically the most identifiable features of a sand and gravel operation, their location on the lower terrace area between Lower Kiger Island and Oregon Highway 20 acts to screen the area from view as well as to minimize objectionable operation characteristics such as dust and noise (Fig. 3).

A limited number of residences are located along Oregon Highway 20 in

the vicinity of the Wildish Sand and Gravel Company (Fig. 2). It is not known whether truck traffic ingress or egress causes any significant conflicts with these homeowners. As the highway is the primary transportation route for aggregate products to both the Corvallis and Albany areas, increased residential development along the highway could act to increase complaints about the Wildish Sand and Gravel operation such as truck traffic vibration, noise, and spillage.

Environmental hazards of the extraction operation upon the island, aside from the impacts to the biotic resources described in previous sections of this paper, concern the effects that dikes, roadways, and extraction pits may have upon the flow of Willamette River floodwaters. "When constructed in the path of floods, [they] can either act as dams, causing floodwaters to rise higher than normal, or divert the force of the current leading to the erosion of valuable agricultural land."<sup>17</sup> Information concerning the existence or degree of such hazards upon Lower Kiger Island is presently unavailable. Lastly, the island is located in a seismically quiet area of the Willamette syncline; no active tectonic faults were identified in this area.

#### PLANNING FRAMEWORK

The aggregate industry is caught between the need to meet an increasing demand for its products and regulations imposed for the protection of the environment. Although private ownership of natural resources is often the reality, the responsibility for their management and allocation is entrusted to the public domain. At issue here is the divergence between private and public resource management objectives. As private industry places an emphasis upon economic efficiency, it is feared that other val-

ues, often more difficult to measure, will not be taken into consideration. "Although efficiency in the private profit sense of the term is highly desirable, even necessary, attribute of any industry, this alone does not guarantee that its actions are wholly in the general public interest."<sup>18</sup> In order that land use planning efforts be truly comprehensive in scope, they must provide for all the resources, uses, public facilities and services in an area. The provision of present and future aggregate needs is an important requisite to the growth of any community; however, equal consideration must be given to other resource needs, the trade-offs and costs being carefully assessed in each case. A well-informed public can aid in the resolution of conflicts arising during the application of aggregate resource policies.

#### The Mined Land Reclamation Law

Reclamation of sand and gravel sites is not an unknown effort in the sand and gravel industry. Thirty-nine states have enacted legislation regulating surface mining operations and providing for some degree of reclamation of mined-out lands.<sup>19</sup> Many depleted sites have been converted into functional land areas, to the benefit of both the industry and the community. The 1971 Oregon Legislative Assembly passed the Mined Land Reclamation Law. Its purposes are as follows:

- 1) To provide that the usefulness, productivity and scenic values of all lands and water resources affected by surface mining operations within this state shall receive the greatest practical degree of protection and reclamation necessary for their intended subsequent use.
- 2) To provide for cooperation between private and governmental entities in carrying out the purposes of the Mined Land Reclamation Law.<sup>20</sup>

The provisions of the law apply to any surface mining operation that

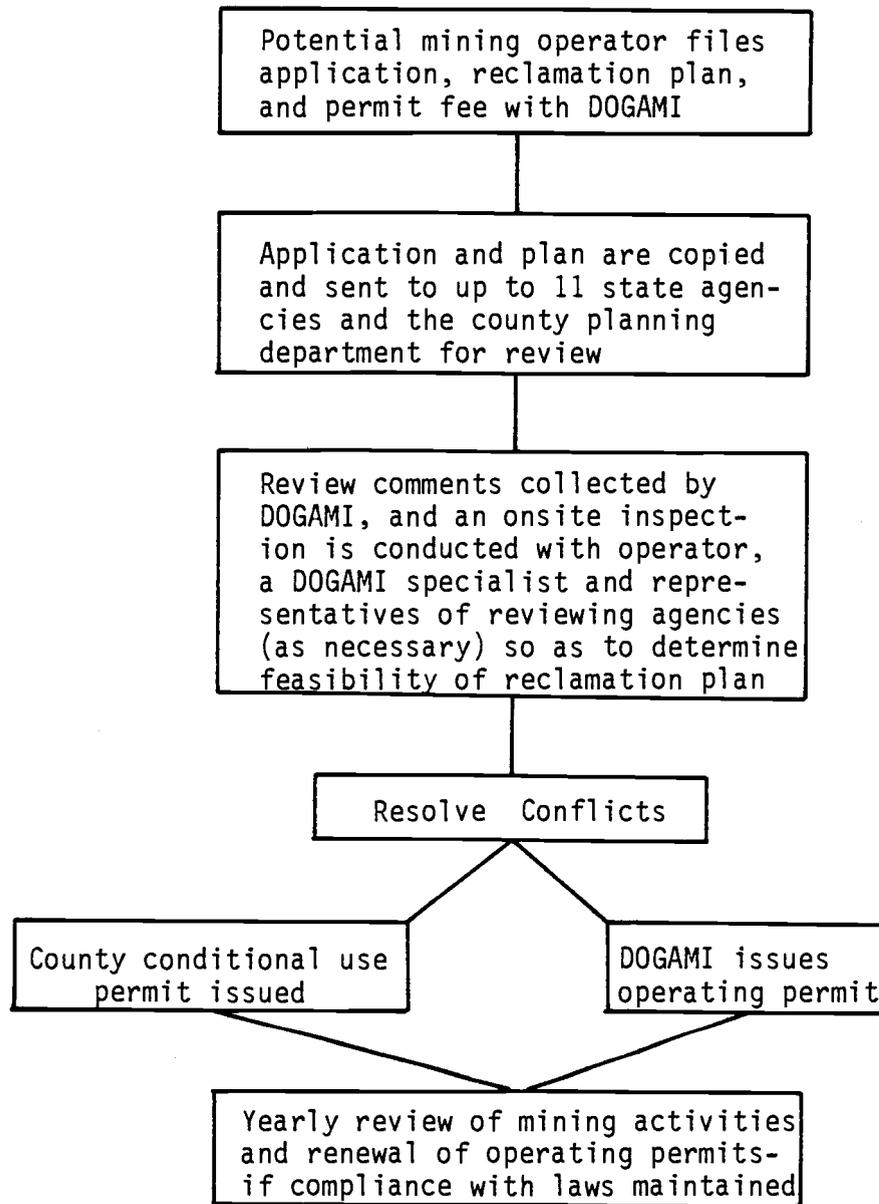
affects more than one acre of land or that extracts more than 2500 cubic yards of minerals from a site within a period of one year. The State Department of Geology and Mineral Industries (DOGAMI) has been directed to administer the Law. DOGAMI procedures are designed to allow as much input into the reclamation plan as possible, to minimize conflict with other land uses, and to insure performance of the planned reclamation. The Mined Land Reclamation Law is funded by money received from operating permits and yearly permit renewals.

The procedural steps that the potential mining operator must follow begin with the submission of an application, a reclamation plan and a permit fee to DOGAMI (Fig. 4). This information is then submitted for review to eleven state agencies and to the County planning department. Review comments are collected and evaluated by DOGAMI specialists. An on-site inspection is arranged with the operator, a DOGAMI specialist and representatives of appropriate state agencies to evaluate the feasibility of the reclamation plan, resolve conflicts and determine the amount of bond, or security deposit, that needs to be posted by the operator. This bond is conditioned upon the faithful performance of the reclamation plan and other requirements of the Law; it is a sum equal to the estimated cost of the completion of the reclamation work, yet it cannot be set at a sum greater than \$500 per acre. DOGAMI issues an operating permit when the operator accepts the modified reclamation plan and posts the required bond. This action is coordinated with the issuance of a conditional use permit to the operator by the County.

#### Applicable Statewide Planning Goals and Linn County Planning

Goal 3, Agricultural Lands, directs planners to preserve and maintain agricultural lands through the establishment of Exclusive Farm Use zones.

FIG. 4. Procedural Steps for Mining Permits



Agricultural lands include all soils within SCS soil capability classes I-IV in western Oregon. As the soils on Lower Kiger Island are predominantly Class II, the site has been designated Exclusive Farm Use; aggregate extraction is a conditional use within this zone. If aggregate extraction is to occur within productive agricultural lands, provisions for returning the land to a form and contour suitable for long-term resource production must be thoroughly evaluated.<sup>21</sup>

Goal 5, Open Spaces, Scenic and Historic Areas and Natural Resources, directs the County to inventory the location, quality, and quantity of mineral and aggregate resources as well as sites for the processing and removal of such resources. Also addressed is the need to plan for interim, transitional, and "second use" utilization as well as for primary use. Where conflicting uses have been identified for such resource areas, the County must assess the economic, social, environmental and energy consequences of those conflicting uses and thereby develop programs to achieve the intent of the goal.

Conditional use permits are now issued by the Linn County Planning Department on the basis of compliance with minimum standards regarding water and air pollution, depth of excavation, access road development and control of operating time. Additionally, the County may require a schedule of rehabilitation for portions of the property as their use for sand and gravel resource operation is completed or terminated.<sup>22</sup> These standards are outlined within the existing Linn County Zoning Ordinance which will be revised following the completion of the County comprehensive plan.

Overall goals, now being developed for the Aggregate and Mineral Extraction segment of the comprehensive plan (Goal 5), include the promotion of wise management and efficient use of all aggregate resources to meet present and future County needs, the coordination of the development of

aggregate resources with other uses of the land, the minimization of negative environmental and aesthetic impacts of extraction areas, and the provision of the ultimate rehabilitation and restoration of the site to land uses compatible with the surrounding neighborhood and community.

Goal 15, the Willamette River Greenway, requires protection of Greenway resources through local comprehensive plans and ordinances. It is not the intent of the Goal to restrict established, lawful uses within the Greenway. As the Greenway boundary usually applies to lands along the Willamette River within 150 feet of the ordinary low water line, most of Lower Kiger Island is excluded from direct Greenway consideration (Fig. 2). However, as adjacent land use activities affect the environmental quality of the Willamette River, the County must develop regulations to minimize adverse effects on water quality, fish and wildlife, vegetation, bank stabilization, scenic values, and to guarantee necessary reclamation.

#### Roles of DOGAMI and the Linn County Planning Department

Whereas none of the state agencies, such as the Department of Environmental Quality and the Corps of Engineers, has been given the statutory power to deny issuance of an operating permit, both DOGAMI and the county can modify or deny a reclamation plan. DOGAMI can suspend mining activity as a result of non-compliance, and the County can refuse to issue a conditional use permit to an operator if the standards and policies within the County zoning ordinance have not been met. "The two roles are complementary: the Oregon Department of Geology and Mineral Industries has expertise in mining geology, mining techniques, and reclamation processes; the County has the best knowledge of local needs."<sup>23</sup> The requirements and policies of the Mined Land Reclamation Law and the Linn County zoning ordinance are similar, and, in fact, it may be suggested that there is unneces-

sary duplication of regulation; however, this overlap acts to ensure that critical areas of environmental concern are adequately addressed.

### Planning Needs

As the existence of one land use often precludes the establishment of, or is in conflict with, other land uses, it becomes an important, yet difficult, task to assess relative resource needs and to provide for an optimal allocation of resource uses. Unfortunately, Linn County planners are presently ill-equipped to guide the balancing of applicable goals pertaining to aggregate resource areas.<sup>24</sup> Linn County is at a distinct disadvantage at this time because a Rock Materials Resources Report for the County has not been completed as it has for Benton County. Supply and demand for aggregate material within Linn and Benton counties should be assessed concurrently, as the principal sources of this commodity are found along a common border, the Willamette River, and they supply a common market area. Secondly, a report much needed by county planners, Preliminary Guidelines for Incorporating Aggregate Resource Considerations in Comprehensive Plans," has not yet been undertaken.<sup>25</sup> The land status of all active and potential mining sites, particularly near urban centers, should be inventoried. Just as agricultural lands are classed according to the degree of limitations posed to normal farming practices, consideration ought to be given to classifying existing and potential aggregate resource lands according to the quality and quantity of aggregate material, existing and surrounding land uses, and proximity to market.

The Linn and Benton county planning departments ought to consider a mutual cross-zone agreement which would make the present main Willamette River channel the working boundary for land use and administrative purposes. This makes good sense for three reasons: first, the Wildish Sand and Gravel

Company has expanded its operation from Lower Kiger Island, in Linn County, to the Reynolds' property, in Benton County; second, ed Reynolds now farms portions of north Kiger Island as well as his own land; and third, the assessors' offices from both counties have been using the main Willamette River channel for assessment purposes.

#### PRESENT RECLAMATION ON LOWER KIGER ISLAND

It must be emphasized that, as the owner of Lower Kiger Island, Wildish Sand and Gravel retains the right to determine the reclamation land uses for the mined-out site. The company has been commended by DOGAMI for its continued compliance with the requirements of the Mined Lands Reclamation Law. However, specific information concerning present operations or future reclamation plans is proprietary in nature so that Wildish Sand and Gravel can protect its interests, maintain a competitive advantage over its competitors, and keep its reclamation options open for the future. The resulting reclamation plan submitted to DOGAMI is purposely general, providing only that information which is required by law.

Present reclamation plans call for returning most of the site to agriculture, while a portion may be left as permanent impoundments designed for recreational purposes, wildlife habitat, or irrigation ponds.<sup>26</sup> As described earlier, Wildish Sand and Gravel is continuing to backfill the 36-acre old pit area with construction debris, wood waste material, and operations screenings. Topsoil has been saved along the eastern side of this pit for replacement over the filled pit when recontouring has been completed (Fig. 3). It is not known how much topsoil has been stockpiled here or to what depth it will be replaced over this area. The old sand pit within Section 7 has been completely filled and recontoured to the pre-existing

land level, and a berm of overburden and topsoil is being retained along the southeastern side of the section to be used in the reclamation of the area of expanded aggregate extraction.

Wildish Sand and Gravel's role should not be that of an adversary between those agencies that regulate their activities. "Reclamation is a planning process that allows the operator-landowner to maximize his total profits by continued utilization of mined-out land."<sup>27</sup> Numerous incentives exist favoring the development of an effective and comprehensive reclamation plan: (1) an improved public image can be secured especially if the identified ultimate land use is to become an asset to the community, and (2) as each operational step contributing to the extraction of sand and gravel offers opportunities for site redevelopment, simultaneous extraction and reclamation can increase operations efficiency and decrease total costs. For example, as much overburden is unusable for processing and must be moved anyway, it makes sense to have a reclamation plan that outlines the approximate locations of subsequent landforms.

Some level of reclamation is always economically feasible and to the industry's advantage. The value of reclamation can be estimated by taking the purchase price of the land and comparing estimates of the values of the land reclaimed and unreclaimed. A figure can thus be obtained that can be used to show how much can be spent each year for reclamation, with the owner still receiving a profit on the expenditure if the land is later sold. Obviously, all estimated values would be highly individual and must be obtained for each area and for each degree of reclamation and category of future land use, but according to a paper by Dunn (1970), "it would seem that an estimated increase in value of the land by a factor of 5 is a fairly conservative estimate of the improvement of value by rehabilitation."<sup>28</sup>

## RECLAMATION OPTIONS

Understandably, Wildish Sand and Gravel is interested in maximizing its return upon their reclamation investment. Given that the aggregate reserves will not be depleted for years to come on Lower Kiger Island, it is difficult for Wildish Sand and Gravel to justify a firm commitment to any one reclamation use or plan because deposit characteristics, market conditions and community needs can be so variable, requiring amendments to reclamation plans. Nevertheless, this need not be interpreted as a prescription for inaction; a careful evaluation of the site's existing land uses, extraction operation, and the functional relationships of all the reclamation land uses may be the best way that Wildish Sand and Gravel can assess its alternatives and be able to maximize its profits in the long term.

Recreation

A problem arises when trying to obtain a reliable assessment of Linn County's recreational needs by virtue of the fact that the County is a recreation importer, meaning that more people are attracted to the County than leave it for recreational purposes.<sup>29</sup> The needs may be greater than when assessed on the basis of County population alone. In any case, the need categories are basically indisputable (Table 2). The Linn County Parks Department is pursuing a vigorous program of providing district and regional parks on a more local level. Specific County needs include the development of designated flat-water swimming areas and campsite areas.<sup>30</sup>

Given the present energy situation, the State Parks Department is now encouraging recreational development within the Willamette Valley and thus closer to urban areas. Lower Kiger Island is conveniently situated four

<i>Facility</i>	<i>Unit</i>	<i>Supply</i>	<i>Gross Need</i>	<i>Net Need</i>		
				<i>1975</i>	<i>1980</i>	<i>1990</i>
Campsites	Site	861	737	(124)	(45)	109
Picnic Tables	Table	853	977	124	242	410
Swimming Pools	Pool	5	11	6	7	9
Boat Launch Lanes	Lane	26	47	21	27	36
Swim Beach	Feet	4300	2840	(1460)	(1091)	(600)
Walking/Hiking Trails	Mile	48	274	226	260	304
Biking Trails	Mile	38	175	137	161	190
Bridle Trails	Mile	37	60	23	31	41
Ball Fields	Field	110	32	(78)	(74)	(69)
Tennis Courts	Court	17	32	15	19	24
ORV Trails	Court	0	20	20	22	26
Golf	Mile	9	63	54	54	63
Neighborhood Parks	Holes	106.0	404.0	398.0	343.5	405.5
Community Parks	Acres	37.0	808.0	771.0	862.0	986.0
District Parks	Acres	35.0	1212.0	1177.0	1311.5	1497.5
Regional Parks	Acres	577.0	2020.0	1443.0	1671.0	1981.0

SOURCE: Oregon State Comprehensive Outdoor Recreation Plan

miles miles from Corvallis and 6 miles from Albany off Oregon Highway 20. River access to the island is ideal, with boat or canoe passage north to Albany or south to Corvallis. Existing and future extraction ponds can be developed as flat-water swimming areas, and the leave strip of riparian vegetation around the periphery of the island can provide for picnic and/or coming needs. Even those areas that have been cleared of vegetation can be replanted and put to recreational use. Recreational development upon Lower Kiger Island would be consistent with Greenway expectations. Monetary assistance for reclaiming surface-mined lands for recreation has been provided by the Department of the Interior, Federal Heritage Conservation and Recreation Service; both the County planners and Wildish Sand and Gravel may want to investigate this source of funding in the future.

One major constraint to recreational development upon Lower Kiger Island could be the separation of the extraction and reclamation opera-

tions. Wildish Sand and Gravel should take advantage of the opportunities to coordinate the two. For example, if Wildish Sand and Gravel intends to develop the extraction ponds for recreational purposes, they should not be dumping waste materials back into the pits, as the water depth will just be decreased.<sup>31</sup> Rather, they might use this material to build dry land areas for parking and camping areas. Physical constraints to recreational development include its floodplain location, restricting activities during the rainy, winter months, and its lack of upland areas that would be better suited for recreational facilities.

The decision to provide private or public recreational opportunities rests with Wildish Sand and Gravel; however, "the concern for liability has precluded the enhancement of private lands for recreational use by the public."<sup>32</sup> If portions of the island are to be reclaimed to other uses such as agriculture, the problem of public trespass upon those areas must also be taken into consideration.

### Agriculture

Lower Kiger Island has productive soils, and Exclusive Farm Use zoning designation, and a floodplain location that all act to restrict the development of intensive land uses. As Corvallis and Albany grow toward one another in the coming years, it will become increasingly important to preserve and protect productive agricultural lands close to those urbanizing areas. If major portions of the site are to be returned to agriculture, it is essential that as much topsoil as possible be retained and stockpiled on site. Agriculture is also compatible with Greenway expectations.

The depth of excavation will influence the ability to reclaim the island to agricultural uses. It would be difficult to return the site to grade if gravels were extracted to a great depth over large portions of

the site. Accordingly, Wildish Sand and Gravel must determine the appropriate depth necessary to allow adequate restoration of the site.

In order to develop the multiple-use potential of Lower Kiger Island, agriculture could occupy large central portions of the site, while the extraction ponds that are to remain and the peripheral areas of riparian vegetation could be reclaimed for other land uses.

#### Fish and Wildlife Management

Opportunities exist for the development of extractive ponds for fish breeding purposes. Wildish Sand and Gravel is now investigating this possibility." These shallow ponds would contain relatively warm water that is recharged with the groundwaters of the area. A pond depth of between nine and 20 feet is ideal for this purpose. Secondly, the removal of aggregate material off the gravel bars produces shallow waters that provide excellent spawning beds for migratory fish in the Willamette River.<sup>34</sup> An indirect benefit resulting from gravel bar extraction is that the potential for opposite bank erosion could be reduced because the faster flowing waters would be drawn more toward the center of the river channel.

Lower Kiger Island's suitability as a wildlife habitat is a function of the amount of riparian vegetation that is left untouched along the periphery of the island, how much and how soon additional vegetation is replanted, and the degree of human occupancy upon the site.

#### Sanitary Land Fill

In earlier sections of this paper it has been noted that Wildish Sand and Gravel is backfilling demolition material and operational waste materials into the large old 36-acre extraction pond under two DEQ permits. This practice should not present any problems as the pits are lined with clay sealants, and in areas where fill material is lacking, this appears to be

a good way to help return the pit to grade.

However, the feasibility of utilizing mined-out areas on Lower Kiger Island for sanitary land fill purposes is questionable. Even though a recent paper by Summer (1978) indicates that clay sealants could protect water supplies and soils from liquid and toxic leachates, the danger of a river channel change or flooding into these areas would probably cause the County planning commission and the DEQ to disapprove of such a request.<sup>35</sup> Only non-putrisable waste, such as the demolition material and operational waste materials can be permitted within mined-out areas on the island.

#### RECOMMENDATIONS

A number of needs have been identified to facilitate planning efforts for aggregate resources in Linn County, including the classification of all existing and potential aggregate sites, and the completion of a rock materials resources report, the establishment of a cross-zone, County boundary agreement with Benton County, and the completion of "Preliminary Guidelines for Incorporating Aggregate Resource Considerations in Comprehensive Plans." It is particularly important that these needs be met as soon as possible, particularly with regard to Lower Kiger Island. As other less productive aggregate sites are depleted of their resources in the future, aggregate producers will be forced to relocate at new sites further from centers of demand, thereby dramatically increasing transportation costs. If this situation develops in the Linn and Benton county area, increased demand for aggregate materials at Lower Kiger Island may result. This possibility emphasizes the need to inventory the existing and potential aggregate resource sites and to take measures to protect those best suited to meet demand.

The Department of Geology and Mineral Industries can continue to offer

assistance to aggregate producers, not only so that the requirements of the Mined Lands Reclamation Law are met, but also to encourage reclamation as an opportunity to maximize total profits from mined-out land. One of DOGAMI's functions is to provide cooperation between private and governmental bodies in carrying out the purposes of the Law; that function is an effective means to assure wise management and efficient use of all aggregate resources.

The Wildish Sand and Gravel Company should carefully weigh all the costs and the benefits of aggregate extraction within each section of Lower Kiger Island. This is to suggest that the economics of reclamation is no less important than economic efficiency of the extraction process. Perhaps the welfare of the citizens of the County would best be met by a decision not to mine sections of marginal aggregate productivity upon the island, and to evaluate instead the potential of those areas for wildlife habitat or recreation uses.

#### SUMMARY

This study provides a site analysis of a sand and gravel extraction site, Lower Kiger Island. In addition, the opportunities and constraints of potential reclamation land uses were evaluated, and it was concluded that a number of them could be accommodated together in a reclamation plan.

The findings of this study support the statement that "The land use of depleted sites depends upon what is physically possible, economically profitable, and institutionally and socially desirable."<sup>36</sup> Lower Kiger Island's floodplain location severely restricts structural development and therefore limits the number and intensity of reclamation land uses. However, the site's location mid-way between Corvallis and Albany is appropriate for the development of both recreation and agriculture as reclama-

tion land uses. Extraction ponds can provide opportunities for flat-water swimming or boating and fish management. The retention of the island's productive soils during the extractive process can provide for the return of large portions of the site to agricultural use. Existing and replanted riparian vegetation can support a wide variety of wildlife upon this riverine environment.

Not only is the reclamation of mined-out aggregate sites required by state law, but it is also the means by which the operator can maximize his total profits by continued utilization of the land. As regulatory agencies, the Linn County Planning Department and the Department of Geology and Mineral Industries must assure that an acceptable reclamation plan for Lower Kiger Island is developed. The status of all known aggregate resource sites within the County, whether active, inactive, abandoned or reclaimed, must be determined in order for the County to promote the wise management and efficient use of its mineral resources now and in the future; this must be done in a manner designed for the protection and subsequent beneficial use of the mined land.

## FOOTNOTES

<sup>1</sup>Herbert G. Schlicker, Jerry J. Gray, James L. Bela, Rock Material Resources of Benton County, Oregon, Short Paper 27 (Portland, Oregon: State of Oregon Department of Geology and Mineral Industries, 1978).

<sup>2</sup>Montagne and Associates, Aggregate Resource Management and the Aggregate Industry in Comprehensive Land Use Planning (Salem, Oregon: Montagne and Associates, 1975).

<sup>3</sup>Ibid., p. 1.

<sup>4</sup>Julia M. Friedman, Ernest G. Niemi, and W. Ed Whitelaw, Analysis and Forecasts of the Demand for Rock Materials in Oregon, Special Paper 5, Economic Consultants, Ltd. (Portland, Oregon: 1979), p. 1.

Montagne and Associates, p. 21.

<sup>5</sup>Friedman, Niemi, and Whitelaw, p. 16.

<sup>6</sup>Ibid., p. viii.

<sup>7</sup>Schlicker, Gray, and Bela, p. 30.

<sup>8</sup>Ibid., p. 1.

<sup>9</sup>Oregon Revised Statutes, Reclamation of Mining Lands, Vol. 4, Title 43, Sec. 517.750-517.900 (Salem, Oregon: Legislative Council Committee of the Legislative Assembly, 1977 Reprint), p. 577.

<sup>10</sup>Corvallis Planning Department, and Albany Planning Department, 1979.

<sup>11</sup>Schlicker, Gray, and Bela, Table 1, "Benton County Rock Material Survey Data," map insert.

<sup>12</sup>Benton County Planning Department, "The Plan for the Willamette River Inventory and Greenway Areas of Benton County; A Technical Report" (Corvallis, Oregon: 1979), p. 36.

<sup>13</sup>Department of Geology and Mineral Industries, Report of On-Site Inspection, Ident. No. 02-0014 (June, 1979), p. 1.

<sup>14</sup>Confidential "Mining Activity Report" information.

<sup>15</sup>Department of the Army, Portland District Corps of Engineers, "Public Notice 071-OYA-1-003165: Commercial Dredging, Willamette River--Mile

125--In Linn County Near Corvallis, Oregon" (Portland, Oregon: 1979).

<sup>16</sup>Tim Hendrix, personal interview, September, 1979.

<sup>17</sup>Schlicker, Gray, and Bela, p. 15.

<sup>18</sup>Marion Clawson, Forests for Whom and for What (Baltimore, Maryland: John Hopkins University Press, 1975), p. 134.

<sup>19</sup>Edgar A. Imhoff et al., "A Guide to State Programs for the Reclamation of Surface Mined Areas," Geological Survey Circular 731 (Arlington, Virginia: United States Geological Survey, 1976).

<sup>20</sup>Oregon Revised Statues, p. 578.

<sup>21</sup>Linn County Planning Department, "Aggregate and Mineral Resources," draft copy of Goals and Policies (Albany, Oregon: 1979).

<sup>22</sup>Linn County Zoning Ordinance, "Criteria and Standards for Quarrying and Related Activity; Conditional Use Permits," Sub-Article 26.1 (1972), pp. 102-107.

<sup>23</sup>Schlicker, Gray, and Bela, p. 22.

<sup>24</sup>Wes Kvarston, letter to Al Cooper, Benton County Planning Department, January 10, 1978.

<sup>25</sup>Claire Puchy, personal communication, July, 1979.

<sup>26</sup>Benton County Planning Department, p. 21.

<sup>27</sup>Schlicker, Gray, and Bela, p. 22.

<sup>28</sup>James R. Dunn, "Reclamation: Its Value to You," Pit and Quarry, Vol. 62, no. 12 (1970), pp. 88-90, 125.

<sup>29</sup>Linn County Planning Department, "Parks and Recreation," draft for Comprehensive Plan, 1979, p. 1.

<sup>30</sup>Benton County Planning Department, Minutes to January 11, 1979 Meeting, p. 2.

<sup>31</sup>Schlicker, Gray, and Bela, p. 23.

<sup>32</sup>Robert Lacoss & Mike Hamm, The Fischer Island Reclamation Plan (Eugene, Oregon: Central Blueprint Service, 1978).

<sup>33</sup>Gary Wildish, personal communication, August, 1979.

<sup>34</sup>Bill Forrest, personal communication, August, 1979.

<sup>35</sup>Rebecca Mae Summer, "Sand and Gravel Reclamation Factors, Colorado County, Texas," Minerals Engineering, Vol. 30, no. 1 (1978), pp. 45-47.

<sup>36</sup>David R. Jensen, Selecting Land Use for Sand and Gravel Sites (Silver Spring, Maryland: National Sand and Gravel Association, 1967).

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APPENDIX A. RECLAMATION PLAN GUIDELINE

Department of Geology and Mineral Industries  
Mined Land Reclamation Division

RECLAMATION PLAN GUIDELINE

- A. NAME, ADDRESS AND TELEPHONE NUMBER OF THE OPERATOR OR HIS AGENT:
- B. NAME AND ADDRESS OF LANDOWNER:
- C. LIST OF KNOWN MATERIALS FOR WHICH THE OPERATION IS TO BE CONDUCTED:
1. PROPOSED STARTING DATA:
2. PROPOSED ENDING DATE (IF KNOWN):
- D. OPERATIONAL PLAN:
1. METHOD TO BE EMPLOYED:
- |                   |                |
|-------------------|----------------|
| a. Single Bench   | c. Dredge      |
| b. Multiple Bench | d. Other _____ |
2. TYPES OF EQUIPMENT TO BE USED:
3. DISPOSITION OF OVERBURDEN:
- E. WHAT WILL BE THE PLANNED SUBSEQUENT "BENEFICIAL USE" OF THE PERMIT AREA? THIS CAN INCLUDE, BUT IS NOT LIMITED TO, CONSTRUCTION SITE, SANITARY LAND FILL, PARK, WATER IMPOUNDMENT, AGRICULTURAL USE (BE SPECIFIC, EXAMPLE: GRAZING LAND, CROP TO BE PLANTED, ETC.), FOREST LAND.

- F.1. (a) Reclamation will begin \_\_\_\_\_ days following completion of mining.  
(b) Reclamation will be concurrent with mining. \_\_\_\_\_yes \_\_\_\_\_no
- F.2. PROVISION FOR RECLAIMING MINED LANDS ON A CONTINUING BASIS WHERE FEASIBLE.

G. RECLAMATION PROCEDURES

1. WHAT WILL YOU DO TO INSURE GROUND STABILITY?
2. PROVISION FOR REVEGETATION. (Minimal survival rate is 75% uniformly distributed.)
  - (a) HOW WILL YOU SAVE AND STORE TOPSOIL?
  - (b) WHAT MEASURES WILL YOU TAKE TO PREVENT EITHER WIND OR WATER EROSION OF TOPSOIL DURING STORAGE?
  - (c) WHAT WILL BE THE AVERAGE DEPTH OF TOPSOIL REPLACED ON THE AREA TO BE RECLAIMED.
  - (d) HOW WILL YOU PREPARE SEED BED PRIOR TO PLANTING?
  - (e) WHAT TYPES AND AMOUNTS OF GRASS SEED WILL YOU USE PER ACRE AND HOW WILL THIS BE PLANTED?
  - (f) WHAT TYPES AND AMOUNTS OF FERTILIZER, MULCH, AND LIME WILL YOU USE?
  - (g) WHAT TYPES AND AMOUNTS OF SEEDLINGS AND SHRUBS WILL YOU PLANT?
  - (h) WHEN WILL SEEDING AND PLANTING TAKE PLACE? (Season of Year)

H. WATER AND DRAINAGE

- (a) WHAT PROVISION WILL YOU TAKE TO INSURE PROPER DRAINAGE?
- (b) WHAT PROVISION HAS BEEN TAKEN FOR SILT CONTROL?
- (c) IF WATER IMPOUNDMENT IS TO BE LEFT, SEE PAGE 6.

I. VISUAL SCREENING

(a) WILL YOU EMPLOY VISUAL SCREENING? (If no, explain)

(b) WHAT TYPES AND AMOUNTS OF PLANTS WILL YOU USE?

(c) WHAT WILL BE THE SPACING BETWEEN PLANTS?

J. PROVISION FOR REMOVING STRUCTURES, EQUIPMENT, AND REFUSE FROM THE PERMIT AREA IN ACCORDANCE WITH THE RECLAMATION PLAN.

K. MAP OF AERIAL PHOTO REQUIREMENTS

(a) WILL AREA PHOTO BE SUBMITTED? YES \_\_\_\_\_ NO \_\_\_\_\_  
SCALE \_\_\_\_\_

(b) MAP(S) REQUIREMENTS. THE MAP SHOULD SHOW, BUT IS NOT LIMITED TO:

- (1) SCALE: (1" = 400' to 600')
- (2) NORTH SHALL BE INDICATED
- (3) QUARTER SECTION, SECTION, TOWNSHIP AND RANGE
- (4) DISTANCE AND DIRECTION TO NEAREST MUNICIPALITY
- (5) LOCATIONS AND NAMES OF ALL STREAMS, ROADS, RAILROADS, UTILITIES
- (6) LOCATION AND NAMES OF ADJACENT LANDOWNERS
- (7) ALL OCCUPIED HOUSES WITHIN 500 FEET
- (8) LOCATION OF ALL PROPOSED ACCESS ROADS
- (9) LOCATION OF PLANT, OFFICE AND MAINTENANCE FACILITIES
- (10) SHOW BOUNDARIES OF AREA TO BE PERMITTED
- (11) TYPICAL CROSS-SECTION OF PRESENT GROUND LINE AND PROJECTED GROUND LINE AFTER RECLAMATION
- (12) CONTOUR INTERVAL, DATE OF MAP PREPARATION, NAME OF PERSON PREPARING MAP
- (13) AREA FOR TOPSOIL STORAGE, WASTE DISPOSAL
- (14) A SEPARATE MAP SHOWING GENERAL LOCATION OF THE OPERATING AREA (not larger than 8½" x 11")

(c) A REVISED MAP MAY BE REQUIRED ANNUALLY

L. IF APPLICABLE, WHAT PROVISIONS HAVE BEEN MADE FOR STREAM CHANNEL, BANK STABILIZATION AND REHABILITATION?

M. EVIDENCE, IN WRITTEN FORM, STATING THAT ALL OWNERS OF A LEGAL, EQUITABLE, FIDUCIARY OR POSSESSORY INTEREST IN THE LAND CONCUR WITH THE PROPOSED SUBSEQUENT USE FOR ANY MINING OPERATION COMMENCING SUBSEQUENT TO JULY 1, 1972

N. OTHER PERMITS IF APPLICABLE:

DIVISION OF STATE LANDS

NO. \_\_\_\_\_ DATE \_\_\_\_\_

DEPARTMENT OF ENVIRONMENTAL QUALITY

NO. \_\_\_\_\_ DATE \_\_\_\_\_

COUNTY USE PERMIT

NO. \_\_\_\_\_ DATE \_\_\_\_\_

OTHER (Identify)

\_\_\_\_\_

O. OTHER COMMENTS:

\_\_\_\_\_  
(Signature of Applicant)

TITLE \_\_\_\_\_ DATE \_\_\_\_\_

WATER IMPOUNDMENTS

(1) HOW LARGE WILL THE SURFACE AREA BE, IN ACRES? \_\_\_\_\_

(2) WHAT PROVISIONS HAVE BEEN MADE FOR PUBLIC SAFETY?

(3) WHAT PROVISIONS HAVE YOU MADE TO PREVENT WATER STAGNATION?

(4) WHAT IS THE WATER SOURCE FOR THE IMPOUNDMENT?

(5) WILL THERE BE PUBLIC ACCESS FOR FISHING?